- 22 -

WHAT IS CLAIMED IS:

1.   A demodulation circuit for demodulating a digital transmission signal, wherein

a preliminarily known signal being inserted in said

5   digital transmission signal upon transmission,

said demodulation circuit comprising:

A/D converting means for performing A/D conversion of a base band signal obtained by demodulation of said digital transmission signal; and

10   phase shifting means for causing phase shift of one of said digital transmission signal and said base band signal on the basis of said known signal after digital conversion by said A/D converting means and said known signal upon transmission.

15

2.   A demodulation circuit as set forth in claim 1, which further comprises orthogonal demodulating means for performing orthogonal demodulation of said digital transmission signal formed with an orthogonal modulated

20   signal,

said A/D converting means includes two A/D converters for performing A/D conversion of two base band signals demodulated by said orthogonal demodulating means and having demodulated phases mutually offset for right angle,

25   symbol judgment portion for making judgment of symbols of digital signals converted by said two A/D converters ,

said phase shifting means including comparing portion

for comparing said known signal, for which symbol judgment is performed by said symbol judgment portion with said known signal for transmission, and a phase shifter for causing phase shift of said base band on the basis of a result of 5 comparison by said comparing portion.

3. A demodulation circuit as set forth in claim 1, which further comprises orthogonal demodulating means for performing orthogonal demodulation of said digital 10 transmission signal formed with an orthogonal modulated signal,

said A/D converting means includes two A/D converters for performing A/D conversion of two base band signals demodulated by said orthogonal demodulating means and having 15 demodulated phases mutually offset for right angle,

symbol judgment portion for making judgment of symbols of digital signals converted by said two A/D converters,

said phase shifting means including P/S converter for conversing the digital signal for which symbol judgment is 20 performed by said symbol judgment portion, comparing portion for comparing said known signal serial converted by said P/S converter with said known signal for transmission and a phase shifter for causing phase shift of said base band on the basis of a result of comparison by said comparing portion.

25

4. A demodulation circuit as set forth in claim 3, which further comprises reception data processing portion

obtaining an information data by removing said known signal from the signal converted into a serial data by said P/S converter.

5.   A demodulation circuit as set forth in claim 2, wherein said phase shifter causes phase shift of said digital transmission signal on the basis of the result of comparison by said comparing portion.

6.   A demodulation circuit as set forth in claim 1, wherein said phase shifting means outputs different phase shifting amount for N times, (in which N is an integer greater than or equal to two), for detecting shifting amount to be shifted on the basis of the result of comparison of the known signals for N times with respect to respective phase shifting amounts.

7.   A demodulation circuit as set forth in claim 6, wherein said phase shifting means causes phase shift to a phase where a correlation value of said known signal for transmission and said known signal after digital conversion by said A/D converting means becomes the highest.

8.   A demodulation circuit as set forth in claim 6, wherein said phase shifting means repeats a process for detecting phase amount to be shifted based on the result of comparison for N times for M times, in which M is positive integer to

take an average value of optimal phase shifting amount for M times as a final optimal phase shifting amount.

9.   A demodulation circuit as set forth in claim 1, wherein said digital transmission signal is a signal, in which said information data and said known signal are time multiplexed.

10.   A demodulation circuit as set forth in claim 1, wherein said digital transmission signal has two base band signals having phases mutually shifted for 90° , in which an information data is assigned for one of said base band signals and said known signal is assigned to the other base band signal.

11.   A modulation circuit for modulating a digital signal comprising:

known signal inserting means for inserting a preliminarily known signal to said digital signal; and

modulating means for modulating the digital signal after insertion of said known signal.

12.   A modulation circuit as set forth in claim 11, wherein said modulating means is an orthogonal modulator.

13.   A modulation circuit as set forth in claim 11, wherein said known signal inserting means inserts said known signal to said digital signal in time multiplexing.

14.   A modulation circuit as set forth in claim 11, wherein said known signal inserting means assigns information data to one of two digital signals which are modulated to have

5   phases mutually shifted for 90° and said known signal to the other digital signal.

15.   A demodulation method for demodulating a digital transmission signal, wherein

10   a preliminarily known signal being inserted in said digital transmission signal upon transmission,

said demodulation method comprising:

first step of performing A/D conversion of a base band signal obtained by demodulation of said digital transmission

15   signal; and

second step causing phase shift of one of said digital transmission signal and said base band signal on the basis of said known signal after digital conversion in said first step and said known signal upon transmission.

20

16.   A demodulation method as set forth in claim 15, which further comprises third step of performing orthogonal demodulation of said digital transmission signal formed with an orthogonal modulated signal,

25   said first step includes first sub-step of performing A/D conversion of two base band signals demodulated by said third step and having demodulated phases mutually offset for

90°, and making judgment of symbols of digital signals converted by said two A/D converters,

said second step including second sub-step of comparing said known signal, for which symbol judgment is

5 performed by said first sub-step with said known signal for transmission, and third sub-step of causing phase shift of said base band on the basis of a result of comparison by said second sub-step.

10 17. A demodulation method as set forth in claim 15, which further comprises third step of performing orthogonal demodulation of said digital transmission signal formed with an orthogonal modulated signal,

said first step includes first sub-step of performing

15 A/D conversion of two base band signals demodulated by said third step and having demodulated phases mutually offset for 90°, and making judgment of symbols of digital signals converted by said two A/D converters,

said second step including fourth sub-step conversing

20 the digital signal, for which symbol judgment is performed by said symbol judgment portion, second sub-step of comparing said known signal serial converted by said fourth sub-step with said known signal for transmission and third sub-step of causing phase shift of said base band on the basis of a

25 result of comparison by said fifth sub-step.

18.   A demodulation method as set forth in claim 17, which further comprises fourth step of obtaining an information data by removing said known signal from the signal converted into a serial data by said fourth sub-step.

5

19.   A demodulation method as set forth in claim 16, wherein said second step causes phase shift of said digital transmission signal on the basis of the result of comparison by said second sub-step.

10

20.   A demodulation method as set forth in claim 15, wherein said second step outputs different phase shifting amount for N times, (in which N is an integer greater than or equal to two), for detecting shifting amount to be shifted on the basis

15 of the result of comparison of the known signals for N times with respect to respective phase shifting amounts.

21.   A demodulation method as set forth in claim 20, wherein said second step causes phase shift to a phase where a

20 correlation value of said known signal for transmission and said known signal after digital conversion in said first step becomes the highest.

22.   A demodulation method as set forth in claim 20, wherein

25 said second step repeats a process for detecting phase amount to be shifted based on the result of comparison for N times for M times, in which M is positive integer to take an average

value of optimal phase shifting amount for M times as a final

optimal phase shifting amount.

23.   A demodulation method as set forth in claim 15, wherein

5   said digital transmission signal is a signal, in which said

information data and said known signal are time multiplexed.

24.   A demodulation method as set forth in claim 15, wherein

said digital transmission signal has two base band signals

10   having phases mutually shifted for 90° , in which an

information data is assigned for one of said base band signals

and said known signal is assigned to the other base band

signal.

15   25.   A modulation circuit for modulating a digital signal

comprising:

        fifth step of inserting a preliminarily known signal

to said digital signal; and

        sixth step of modulating the digital signal after

20   insertion of said known signal.

26.   A modulation method as set forth in claim 25, wherein

said modulating means is an orthogonal modulator.

25   27.   A modulation method as set forth in claim 25, wherein

said fifth means inserts said known signal to said digital

signal in time multiplexing.

28. A modulation method as set forth in claim 25, wherein said fifth step assigns information data to one of two digital signals which are modulated to have phases mutually shifted

5 for 90° and said known signal to the other digital signal.